

AMENDMENT TO THE CLAIMS

1-36. (Cancelled)

37. (Previously presented) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

$$0.23 \leq y/(x+y) \leq 0.90$$

when a composition of the high dielectric constant film is expressed as M_xSi_yO , where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

38. (Previously presented) The semiconductor device according to claim 37, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and

the upper barrier film contains the metal, oxygen and nitrogen.

39. (Previously presented) The semiconductor device according to claim 37, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and

the upper barrier film contains the metal, oxygen, silicon and nitrogen.

40. (Previously presented) The semiconductor device according to claim 37, wherein the gate electrode is a metal gate electrode.

41. (Previously presented) The semiconductor device according to claim 37, wherein the lower barrier film is a silicon oxynitride film including the metal.

42. (Previously presented) The semiconductor device according to claim 37, wherein the high dielectric constant film contains nitrogen.

43. (Previously presented) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

$$0.23 \leq y/(x+y) \leq 0.30$$

when a composition of the high dielectric constant film is expressed as $M_xSi_yO_z$, where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

44. (Previously presented) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;
the gate insulating film comprising:
a high dielectric constant film containing a metal, oxygen and silicon; and
a lower barrier film formed below the high dielectric constant film and containing the metal,
oxygen, silicon and nitrogen, wherein

$$x/(x+y) \geq 0.10$$

when the metal is hafnium or zirconium, and

a composition of the lower barrier film is expressed as $M_xSi_yO_zN_w$, where M, O, Si and N
represent the metal, oxygen, silicon and nitrogen, respectively, and $x > 0$, $y > 0$, $z > 0$ and $w > 0$.

45. (Previously presented) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal,
oxygen, silicon and nitrogen, wherein

the high dielectric constant film is formed from a metal oxide ($M_xSi_yO_2$ (M is the metal, and
 $x > y > 0$)) containing silicon.

46. (New) The semiconductor device according to claim 37, wherein

the lower barrier film is amorphous.

47. (New) The semiconductor device according to claim 37, wherein the gate electrode is a polysilicon electrode.

48. (New) The semiconductor device according to claim 37, wherein the gate electrode is made of a material containing silicon.

49. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains chlorine.

50. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains fluorine.

51. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains hydrogen.

52. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains iodine.

53. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains carbon.

54. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film is amorphous.

55. (New) The semiconductor device according to claim 54, wherein the high dielectric constant film contains nitrogen.

56. (New) The semiconductor device according to claim 55, wherein the high dielectric constant film contains crystallites.

57. (New) The semiconductor device according to claim 38, wherein the upper barrier film is amorphous.

58. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film includes a part which is located 1 through 2 nm apart from the gate electrode and which is Hf silicate containing nitrogen.

59. (New) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon, wherein

$$0.23 \leq y/(x+y) \leq 0.90$$

when a composition of the high dielectric constant film is expressed as $M_xSi_yO_z$, where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

60. (New) The semiconductor device according to claim 59, wherein the high dielectric constant film contains nitrogen.

61. (New) The semiconductor device according to claim 59, wherein the gate insulating film comprises a lower barrier film formed below the high dielectric constant film, and the lower barrier film contains the oxygen, silicon and nitrogen.

62. (New) A semiconductor device according to claim 59, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and the upper barrier film contains the metal, oxygen and nitrogen.

63. (New) A semiconductor device according to claim 59, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and the upper barrier film contains the metal, oxygen, silicon and nitrogen.

64. (New) The semiconductor device according to claim 43, wherein the high dielectric constant film contains nitrogen.

65. (New) The semiconductor device according to claim 44, wherein the high dielectric constant film contains nitrogen.

66. (New) The semiconductor device according to claim 45, wherein the high dielectric constant film contains nitrogen.

67. (New) The semiconductor device according to claim 37, wherein the metal in the high dielectric constant film is at least one of hafnium or zirconium.

68. (New) The semiconductor device according to claim 37, wherein the metal in the high dielectric constant film is at least one of hafnium, zirconium, titanium, tantalum, lanthanum, cerium, or aluminum.

69. (New) The semiconductor device according to claim 51, wherein 5×10^{20} to 4×10^{21} hydrogen atoms/cm³ were contained in the high dielectric constant film.

70. (New) The semiconductor device according to claim 54, wherein 3×10^{19} to 4×10^{20} carbon atoms/cm³ were contained in the high dielectric constant film.